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(54) **A method of forming a body, e.g. a dike body, a tubular body designed therefor, and a method of manufacturing such a tubular body.**

(57) This invention relates to a method for the forming of a body consisting substantially of loose or lightly cohesive material, such as sand, for example the core of a dike, a quay, a bank reinforcement, a jetty or a breakwater.

The invention has for its aim so to prepare such a body that this preparation can take place at a fairly low cost. Further, the invention aims to provide a method in which the form of the prepared body is stable.

A further aim of the invention is the provision of a method with the help of which a body can be formed very quickly.

Finally the invention aims to offer a method which makes possible a wide freedom of choice in the form of the body concerned, particularly in respect of its diameter, length and place of the filling inlet.

Thereto the invention provides in general a method which has the characteristic that a tube body (1) of a fabric that is permeable to water and impermeable to the material is provided, said tube body (1) possessing a supply inlet (43), a mixture of the material and water is provided, that mixture is pumped into the tube body through the supply inlet (43), and these such that the tube body (1) gradually fills up with the material and the water is discharged

until the desired extent of filling is achieved, whereafter the pumping is stopped and the supply connection is if necessary closed.

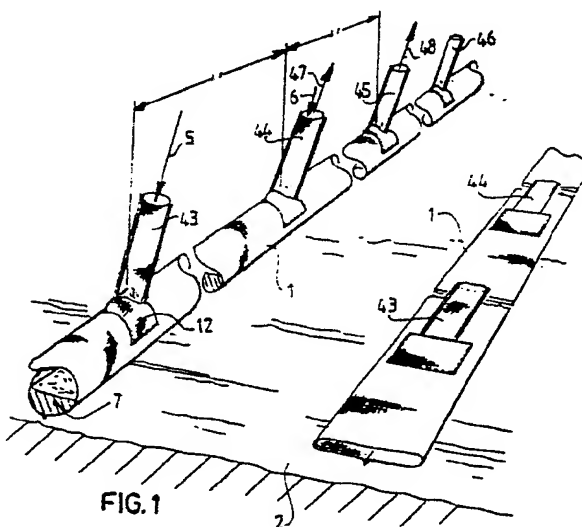


FIG. 1

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A method for the forming of a body, for example the core of a dike, a tube body for use in that method, and a method for preparing such a tube body

This invention relates to a method for the forming of a body consisting substantially of loose or lightly cohesive material, such as sand, for example the core of a dike, a quay, a bank reinforcement, a jetty or a breakwater.

The invention has for its aim so to prepare such a body that this preparation can take place at a fairly low cost. Further, the invention aims to provide a method in which the form of the prepared body is stable.

A further aim of the invention is the provision of a method with the help of which a body can be formed very quickly.

Finally the invention aims to offer a method which makes possible a wide freedom of choice in the form of the body concerned, particularly in respect of its diameter, length and place of the filling inlet.

Thereto the invention provides in general a method which has the characteristic that a tube body of a fabric that is permeable to water and impermeable to the material is provided, said tube body possessing a supply inlet, a mixture of the material and water is provided, that mixture is pumped into the tube body through the supply inlet, and these such that the tube body gradually fills up with the material and the water is discharged until the desired extent of filling is achieved, whereafter the pumping is stopped and the supply connection is if necessary closed.

In general, the intended mixture of the loose or lightly cohesive material such as sand or other ground material and water can easily be obtained by use of known pumping means, with the aid of which the mixture can be drawn by suction from for instance the beds of waterways. Through the pumping of the material to the tube body, the mixture is supplied at a predetermined pressure, whereby the loose material is free to sink and the water can be discharged through the fabric.

It has become apparent that the method is preferably so executed that the water can be discharged not only through the fabric but also via an outlet. To that end the method according to the invention is also preferably carried out so that a tube body which also possesses an outlet is provided.

It should be noted that in the case of relatively long tubular bodies it can be preferable to make use of an embodiment with a plurality of connection tubes.

The method according to the invention can now be carried out so that the tube body is filled section-by-section. To that end the tube is first tied

off in sausage-fashion at a position past the second connection tube, which initially serves as a outlet tube for water. After the desired extent of filling of the section defined by the first two connection tubes has been achieved, the second section is formed by tying off the tube body after the third connection tube, which then serves as an outlet, while the second connection tube now functions as the inlet tube. The procedure is continued until the entire tube body has been filled.

Furthermore it is noted, that the place of any outlet must be so chosen that as little of the loose material as possible is washed away together with the water to be discharged. It will be clear that this depends on, among other things, the flow velocity of the mixture of the material and water in the tube body. It will also be clear that a compromise must be sought between the most rapid possible and the most effective possible filling of the tube body.

The tube body may be regarded as a permanent encasement or containment of the filling material.

The invention extends thus further to a tube body, intended as permanent encasement for loose or lightly coherent material, prepared of a fabric that is permeable to water and impermeable to the material, and provided with at least one connection tube which can serve as an inlet for a mixture of the material and water pumped into the tube and as an outlet for water, said connection tube being fastened to the tube body through a flange portion.

This tube body can advantageously be so embodied that the flange portion is fastened to the inner surface of the tube body and the connection tube extends through an aperture in the tube body. By this is achieved that the large forces that can occur though the pumping in under pressure of the mixture are as evenly distributed as possible, whereby the chance of leakage or a tearing away of an inlet tube from the tube body is minimized.

A very reliable and strong embodiment is that in which a reinforcing textile is situated between the inner surface of the tube body and the flange portion.

A variant, in which the reinforcing textile is a strip which is connected at its two edges around the tube body, has moreover the advantage that the permeability to water of the wall in the region of the input is reduced, whereby the erosion, the local washing away of the ground material, is prevented. Moreover, the inlet region of the basic fabric is reinforced.

In an embodiment that has proved to be very practical, the tube body has the characteristic that

the connection tube comprises number of flat strips joined together in the longitudinal direction of the tube.

In this case that variant is preferred wherein each strip is integrated with a widened portion, said widened portions being connected together to form the relevant flange portion. The continuous seams ensure a good homogeneous transmission of forces and prevent leakage.

In another embodiment the tube body has the characteristic that the form of the strips and the form of the widened portions determine the mutual orientation of the tube body and the connection tube. This orientation can be of importance, for instance, for creating a charging stream in the tube body which is directed more or less in the longitudinal direction of that tube body, or at least does not lie in a substantially radial direction. By this means, too, a relatively favourable distribution of forces is obtained.

With this same background, a variant can be used which has the characteristic that a flange portion displays a portion extending under the opening in the tube body, such that during the pumping in of mixture into the tube body through the connection tube, the stream of mixture acquires a direction different from the radial direction of the tube body.

In order to restrict as far as possible potential damage during transport or after the filling of a tube body with one or more inlet tubes and optionally one or more discharge tubes, that variant can be used having the characteristic that a protection flap fastened to the tube body extends over the transition zone between the connection tube and the tube body, said protection flap being free of the tube body at minimally an edge part and being capable of serving to cover up the connection tube in its folded state before or after use.

A tube body according to the invention can be simply fabricated by connecting together the longitudinal edges of a strip of water-permeable fabric, closing the ends of the tube body thus formed, providing the tube body with an opening and fastening a connection tube to the zone around that opening. In this case the breadth of the strip of fabric determines the circumference of the tube body.

To prepare tubular bodies of other diameters using a given breadth of fabric strip, a method can be used according which a strip of water-permeable fabric is helically wound up so that adjacent edges acquire overlapping zones, after which the overlapping zones are joined together, the ends of the thus formed tube body are closed, the tube body is provided with an opening and a connection tube is fastened to the zone around that opening. This last method has the further advantage that the

seams extend helically, so that they are relatively strong as a consequence of a flat seam construction and of a lesser loading through any change in angular position with respect to the longitudinal direction of the tube body, and the risk of tearing under the high filling-pump pressure is less than in the previously described embodiment.

The invention will now be elucidated by reference to the drawing. In the drawing:

Figure 1 shows a body according to the invention lying ready and partly filled;

Figure 2 shows a connection tube with flange portion;

Figure 3 shows a detail of a tube body, to which the connection tube according to figure 2 is fastened;

Figure 4 shows a detail of a tube body in a variant of the embodiment according to figure 3;

Figure 5 shows the variant according to figure 4 in a condition wherein the connection tube is in its operational position; and

Figure 6 shows the variant according to figures 4 and 5 in a condition in which the connection tube is stored away in a rolled-up state before or after use;

Figure 7 shows an alternative to the embodiment according to figure 5;

Figure 8 shows a condition corresponding to figure 6 of the alternative embodiment according to figure 7;

Figure 9 shows a detail of an embodiment whereof the components are depicted, for the sake of clarity, at some distance from one another, for the purpose of elucidating the manner of fabrication;

Figure 10 shows a detail of a finished tube body corresponding to figure 9;

Figure 11 shows an alternative to the embodiment according to figure 10, in which the input tube is disposed at an angle to the longitudinal direction of the tube body; and

Figure 12 shows a strongly schematic representation of an apparatus for the fabrication of a tube body by the helical winding of a strip of fabric.

Figure 1 shows a tube body 1, that is laid on a bed 2. Tube body 1 consists of fabric permeable to water but impermeable to sand.

Tube body 1 is provided with a multiplicity of connection tubes 43, 44, 45, 46. The filling of tube body 1 can now take place, such that tube body 1 is filled a section at a time. To that end tube body is tied off in the manner of a sausage after the second connection tube 44, which can now initially serve as a supply tube for mixture. After the desired filling of the section determined by these first two connection tubes 43, 44 has been achieved, the second section is formed by tying off tube body 1 after the third connection tube 45, which

can now serve as discharge tube, while the said second connection tube 44 can now serve as the supply tube for mixture. This procedure can be continued until the whole tube body is filled with sand.

The pumping direction of mixture for the filling of the first section is indicated by arrow 5, while the discharge of water is shown by arrow 6. For the filling of the second section, mixture is pumped into tube 44 in accordance with arrow 47 while water is discharged through connection tube 45 in accordance with an arrow 48, and so on.

When the desired extent of filling has been reached in a section, the supply tube can be worked off in a manner to be further described below. After filling of the entire tube body 1, the last discharge tube can also be worked off.

Figure 2 shows the supply tube 3, which consists of two flat parts 8, 9 and connected thereto widened parts 10, 11, which together can form a flange portion 12 (see figure 1).

Figure 3 shows that in a tube body 13 a slit-shaped opening is made, through which connection tube 3 is thrust. The widened portions 10 and 11 are united to form a rectangular flange portion in the manner indicated. The portion 10 extends flat along the inner surface of tube body 13, while the flange portion 11 possesses a turned-back form, such that during the pumping in of mixture through connection tube 3 the stream concerned will not flow radially with respect to tube body 13 but in a more or less axial direction, and no leakage can occur and a good strength of the connection is achieved.

Figure 4 shows the same construction as according to figure 3, but it differs in that a protection flap 15, fastened to tube body 13, extends over the transitional zone between the connection tube 3 and that tube body, said protection flap being sewn to the tube body 13 on three edges 16, 17, 18, such that flap 15 can serve for the covering up of the connection tube 3 in its folded state before or after use.

Figure 5 shows the operational state of the tube body, in which mixture is pumped in according to arrow 5.

Figure 6 shows the connection tube according to figure 4 in its rolled up state. In this figure this connection tube is thus indicated by reference number 3'. The flap 15 covers up the connection tube 3.

Figure 7 shows a view corresponding to figure 5 of an embodiment in which a flap 20 shows a hole 21 for the penetration of connection tube 3. Also this flap 20 is free of tube body 13 at one edge 21.

Figure 8 shows the manner in which the connection tube, which is in this case indicated by 3",

can be stored away under protection flap 20 in a rolled up state.

Figure 9 shows a connection tube 22 with flange portion 23. The connection tube 22 and the flange portion 23 consist of four flat, flexible parts that are joined to one another along four seams 25 and are thus united as an entity.

The connection tube 22 is thrust into the tube body 27 via a hole 26. In that connection zone 28 (see figure 10), the tube body 27 is reinforced by, applied to the inner surface, a strengthening strip 29, which is to that end also provided with a hole 30.

Figure 10 shows a partly cut-away perspective view of the total construction of the tube body 27 with connection tube 22. The reinforcing strip 29 is connected at its two edges by sewing circumferentially to the tube body 27.

Figure 11 shows a variant of figure 10, in which a tube body 31 is provided with a connection tube 32, which in this case forms an angle with the longitudinal axis (not drawn) of the tube body 31. It will be clear from figure 11 that this is achieved by a considered choice of the shapes of the component flat parts 33, 34, 35, 36, which together form the connection tube 32, also to be understood as referring to the flange-part forming broadened portions thereof.

In the preceding descriptions a tube body has always been intended that is made by joining the longitudinal edges of a strip of fabric.

Figure 12 shows a variant, wherein a strip of fabric is wound up helically, such that the adjacent edges acquire overlapping zones, which can be joined together at the position of a sewing station 38.

The fabric strip is provided beforehand at previously chosen places with connection tubes 3' under the protection flaps 15, these connection tubes and protection flaps being so oriented that in the finally formed tube body they extend in the same plane as the longitudinal axis of the formed tube body 39.

After the formation of this tube body 39, it is led through rollers 40 and wound up onto a spool 41. The rollers 40 and the spool 41 are mounted on a rotating drivable frame 42 and are thus together with that frame rotatably arranged, the rotational axis and the rotational velocity of said frame being so chosen that they agree with the winding speed for the formation by helical winding of tube body 39.

Claims

1. A method for the forming of a body consisting substantially of loose or lightly cohesive material, such as sand, for example the core of a dike,

a quay, a bank reinforcement, a jetty or a break-water, characterized in that

a tube body of a fabric that is permeable to water and impermeable to the material is provided, said tube body possessing a supply inlet,

a mixture of the material and water is provided, that mixture is pumped into the tube body through the supply inlet, and these such that the tube body gradually fills up with the material and the water is discharged until the desired extent of filling is achieved,

whereafter the pumping is stopped and the supply connection is if necessary closed.

2. A method as claimed in claim 1, characterized in that a tube body that also possesses an outlet is provided.

3. A tube body intended as permanent encasement for loose or lightly coherent material, prepared of a fabric that is permeable to water and impermeable to the material, and provided with at least one connection tube which can serve as a supply inlet for a mixture of the material and water pumped into the tube and as an outlet for water, said connection tube being fastened to the tube body through a flange portion.

4. A tube body as claimed in claim 3, characterized in that the flange portion is fastened to the inner surface of the tube body and the connection tube extends through an aperture in the tube body.

5. A tube body as claimed in claim 6, characterized in that a reinforcing textile is situated between the inner surface of the tube body and the flange portion.

6. A tube body as claimed in claim 5, characterized in that the reinforcing textile is a strip which is connected at its two edges around the tube body.

7. A tube body as claimed in claims 3 to 6 inclusive, characterized in that the connection tube comprises a number of flat strips joined together in the longitudinal direction of the tube.

8. A tube body as claimed in claim 7, characterized in that each strip forms an entity with a widened portion, said widened portions being connected together to form the relevant flange portion.

9. A tube body as claimed in claim 8, characterized in that the form of the strips and the form of the widened portions determine the mutual orientation of the tube body and the connection tube.

10. A tube body as claimed in claim 4, characterized in that a flange portion displays a portion extending under the opening in the tube body, such that during the pumping in of mixture into the

tube body through the connection tube, the stream of mixture acquires a direction different from the radial direction of the tube body.

11. A tube body as claimed in one of claims 3 to 10 inclusive, characterized in that a protection flap fastened to the tube body extends over the transition zone between the connection tube and the tube body, said protection flap being free of the tube body at minimally an edge part and being capable of serving to cover up the connection tube in its folded state before or after use.

12. A method for the fabrication of a tube body as claimed in one of claims 3 to 11 inclusive, characterized in that the longitudinal edges of a strip of water-permeable fabric are joined together, the ends of the tube body thus formed are closed, the tube body is provided with an opening and a connection tube is fastened to the zone around that opening.

13. A method for the fabrication of a tube body as claimed in one of claims 3 to 11 inclusive, characterized in that a strip of water-permeable fabric is helically wound up so that adjacent edges acquire overlapping zones, after which the overlapping zones are joined together, the ends of the thus formed tube body are closed, the tube body is provided with an opening and a connection tube is fastened to the zone around that opening.

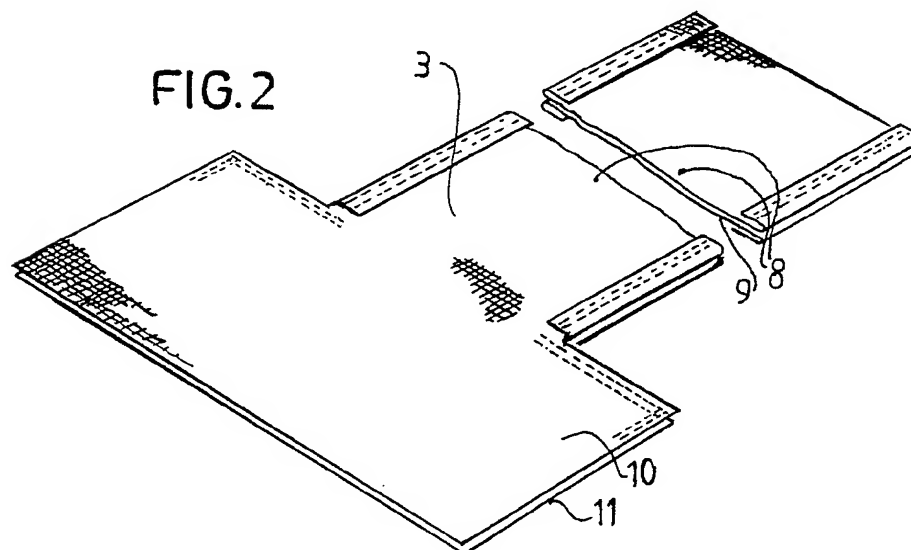
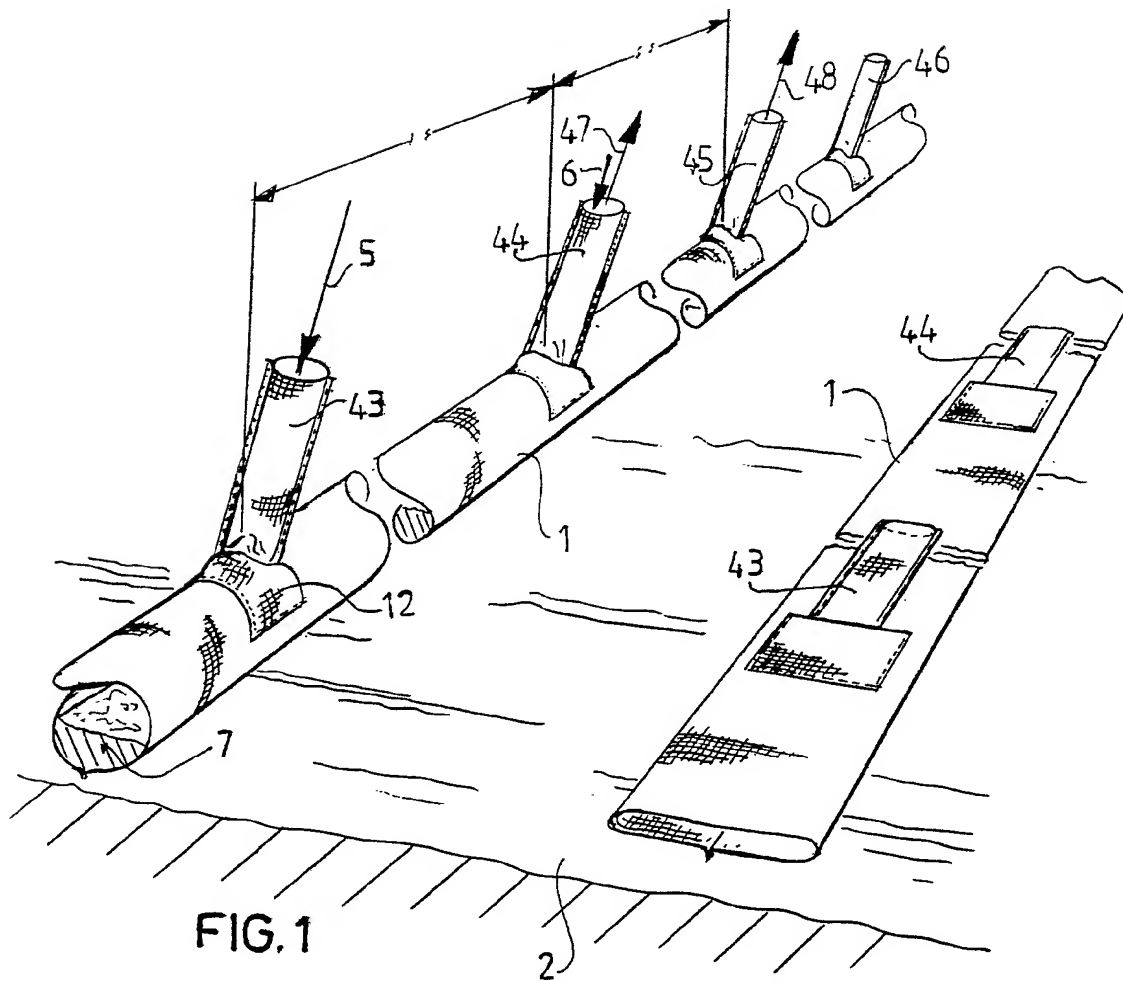


FIG. 3

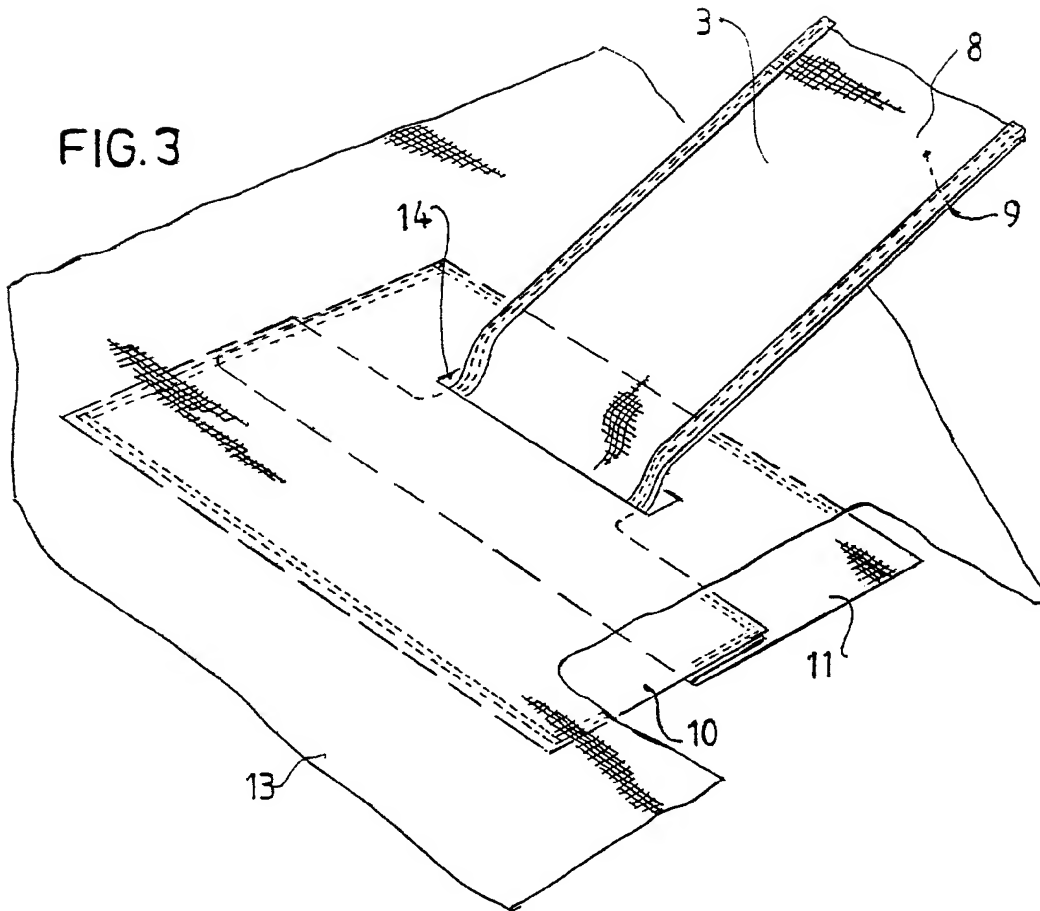
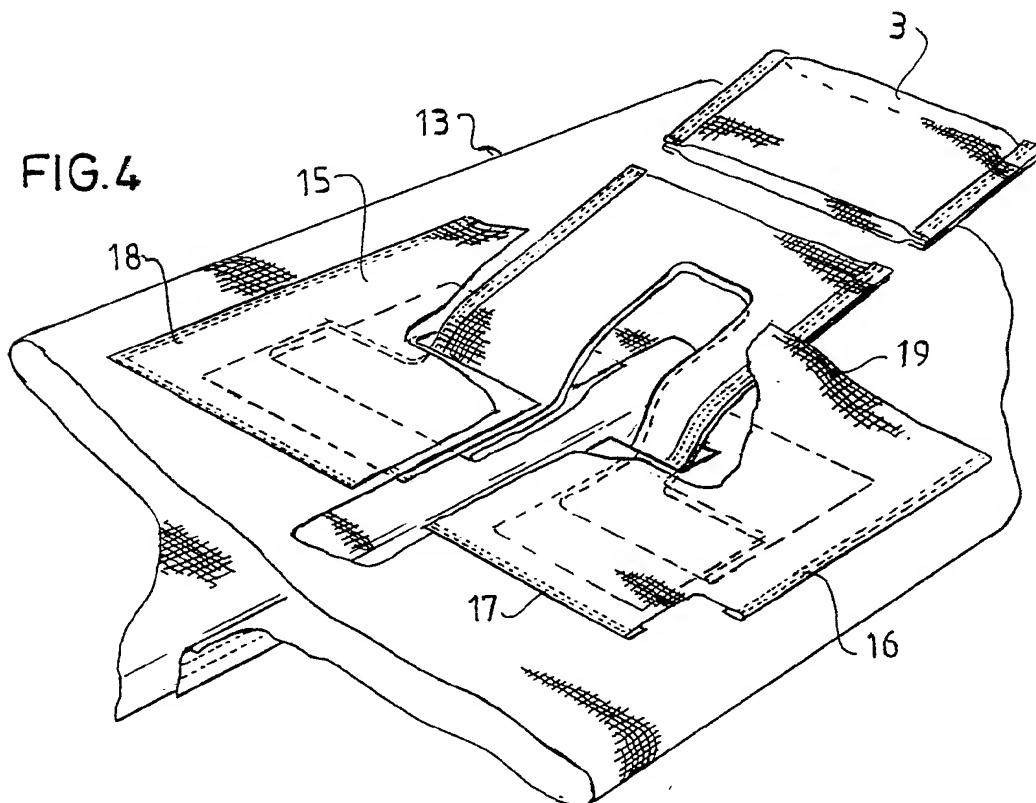


FIG. 4



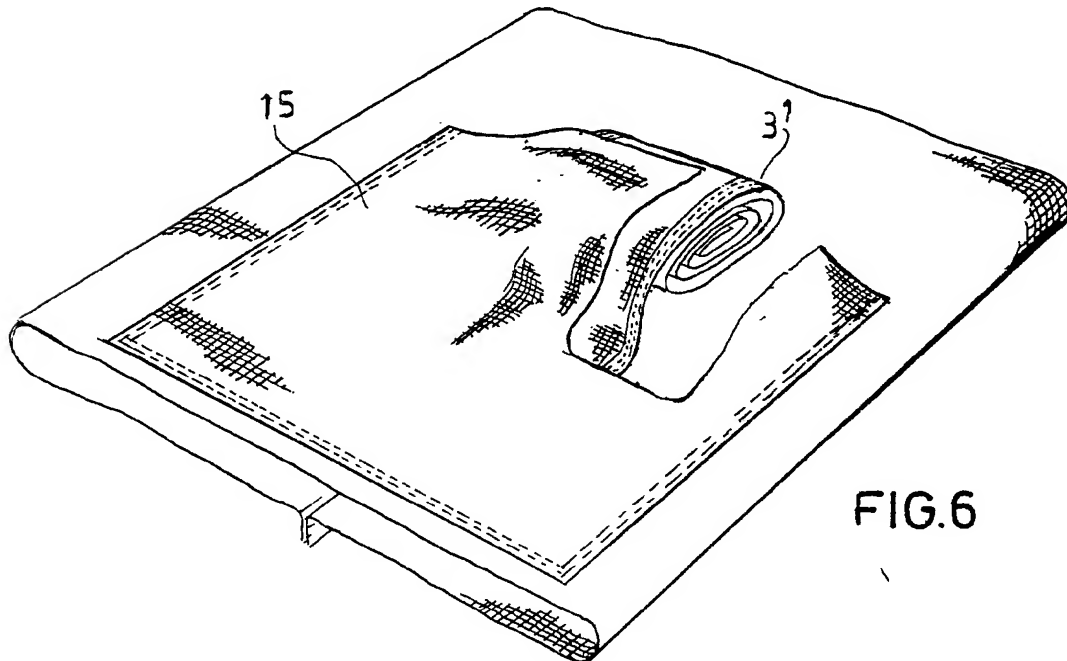
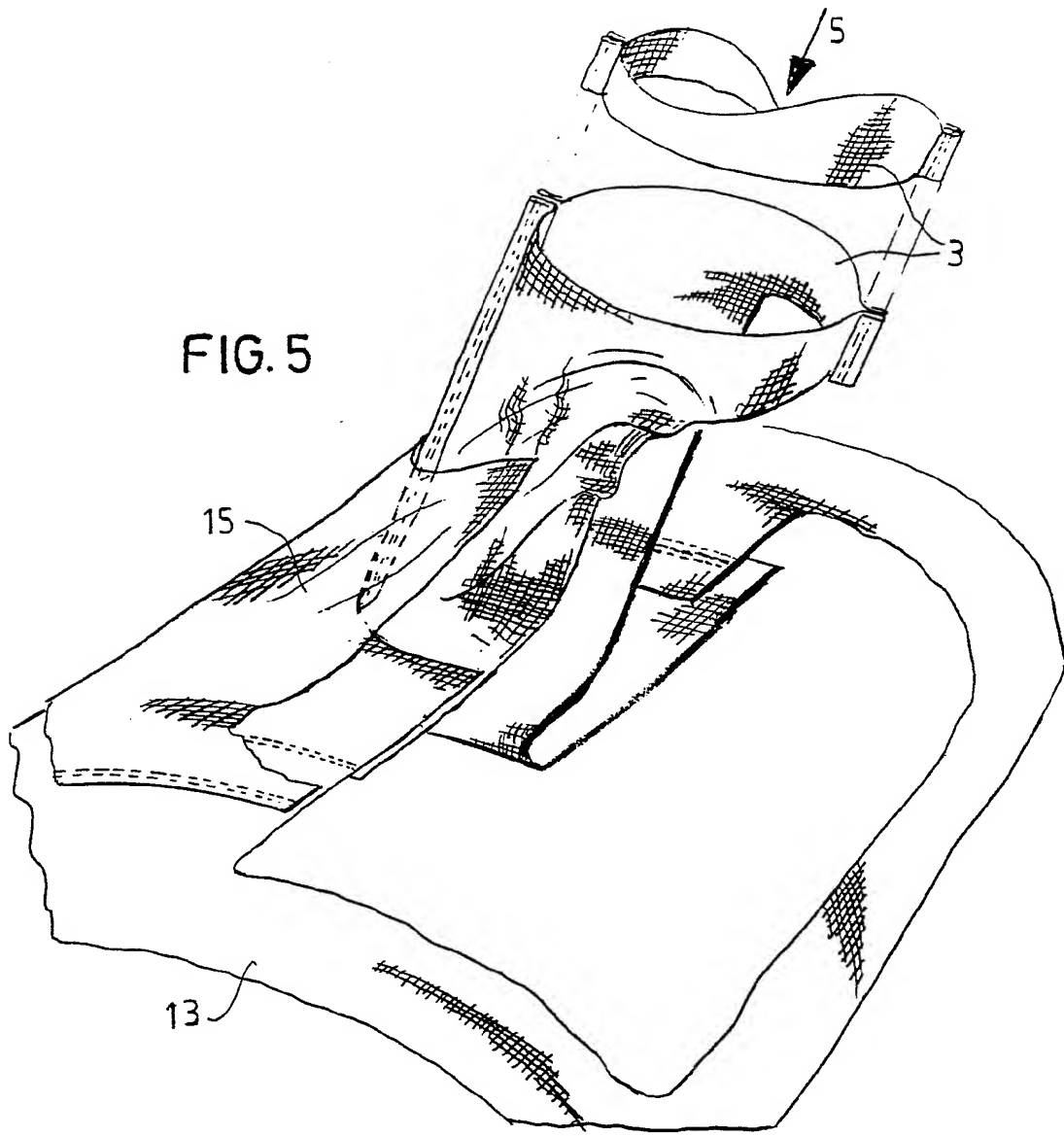


FIG.7

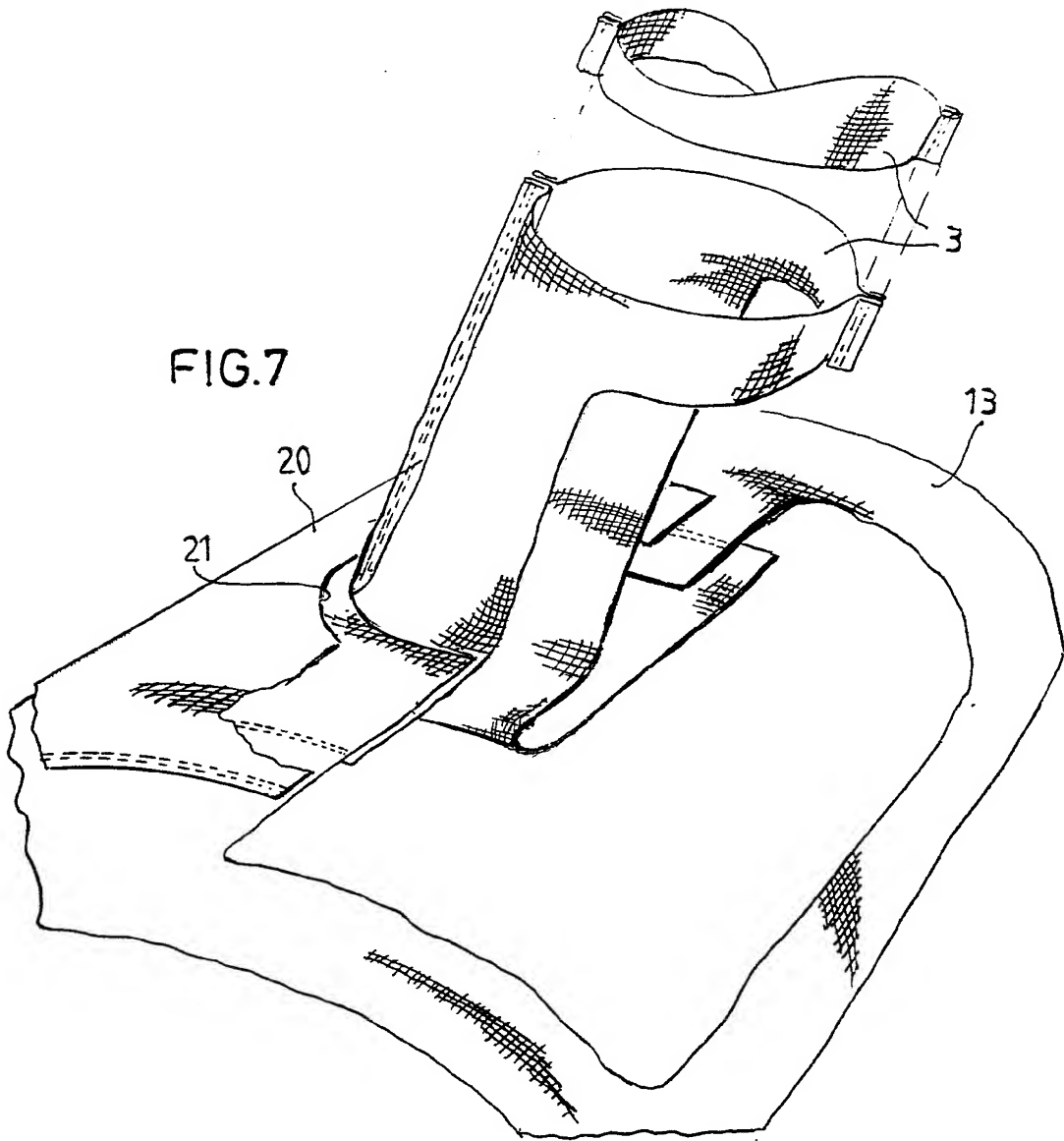
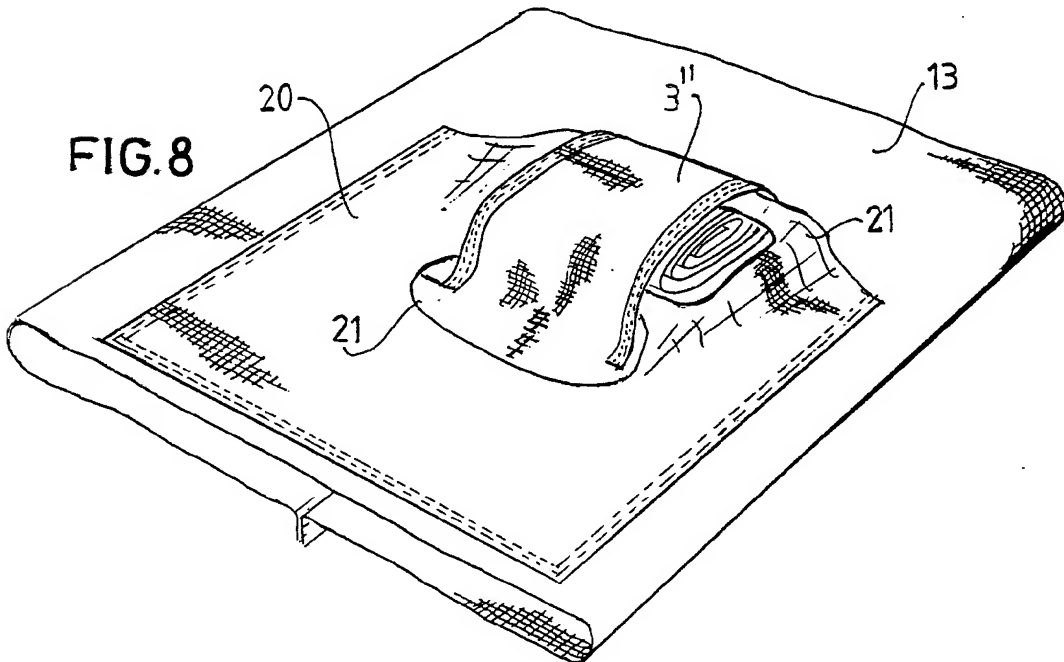


FIG.8



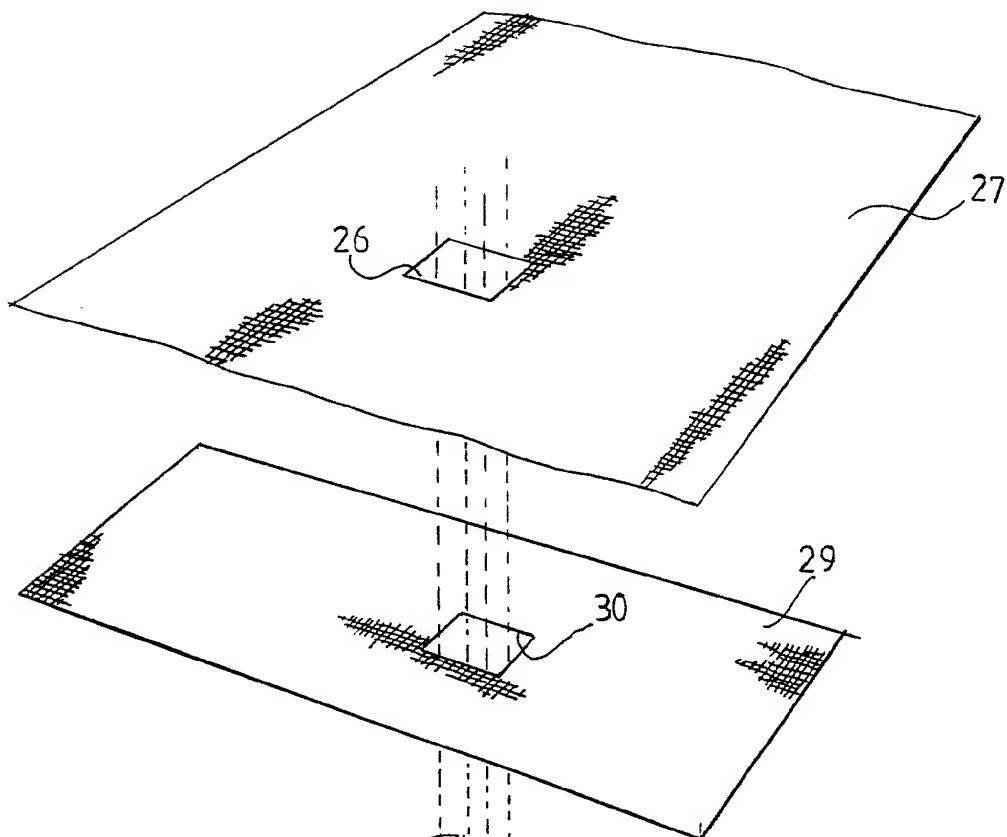


FIG. 9

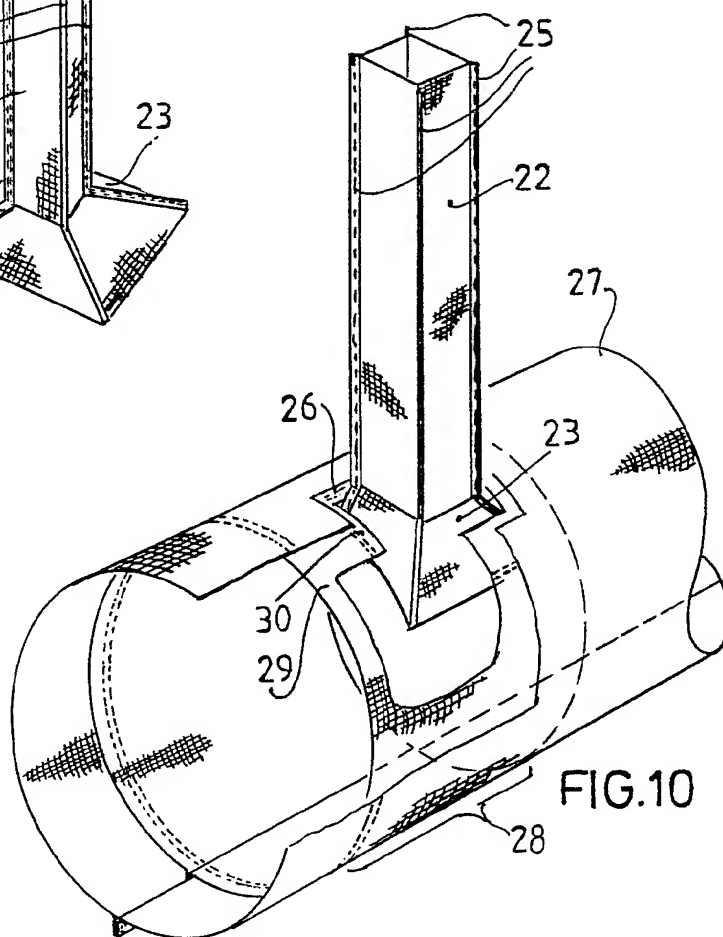
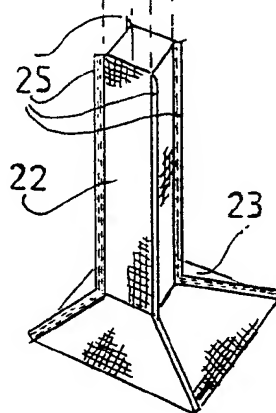


FIG. 10

